Small Business Innovation Research/Small Business Tech Transfer

Development of a High Energy Amplifier for an Airborne Coherent Wind Turbulence Lidar Sensor, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The capacity of coherent LIDAR systems to produce a continuous, real-time, 3D scan of wind velocities via detection of backscatter of atmospheric aerosols in clear-air conditions gives this technology a clear advantage over other atmospheric monitoring technologies. LIDAR has proven its value in a number of applications, including the detection of clear-air turbulence, wind shear, and aircraft wake vortices. Of particular interest under this NASA sub-topic is the development of an airborne Lidar system capable of detecting and measuring aircraft wake vortices and turbulence out ahead of the aircraft in order to improve aviation safety. To perform this task well a Lidar must have certain characteristics and be paired with a highly optimized wake and turbulence processing algorithm. The key development area for detection of turbulence at cruising altitude is Lidar transmit energy and pulsewidth. High energy output on the order of 1.0 mJ for low flying manned or unmanned aircraft (10,000 ft) and 10 mJ for commercial aircraft (30,000 ft) is required. Aerosol density decreases rapidly as a function of altitude and the backscatter coefficient at 30,000 ft is only 4x10-10 as opposed to 2x10-7 at sea-level. Furthermore, commercial airliner crews will need at least 30 seconds reaction time after turbulence is detected in order to take action, requiring the Lidar system to see 6.67 km ahead (assuming an average flight speed of 500 mph). Other key requirements of an airborne Lidar system involve the size and power consumption of the system. The limited space and available electrical power on an aircraft necessitate that a Lidar system be compact and efficient. In addition, the system must be able to be integrated onto the aircraft without inhibiting other flight systems. SIBELLOPTICS proposes a Phase 1 SBIR to develop and test an Er-doped polarization maintaining (PM), large mode area (LMA) fiber amplifier to boost transmitted Lidar power to greater than 1 mJ per pulse.

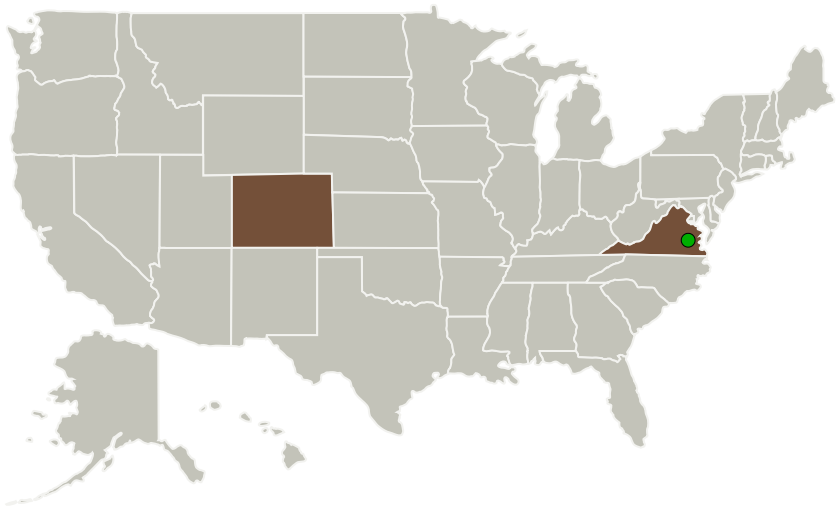
Development of a High Energy Amplifier for an Airborne Coherent Wind Turbulence Lidar Sensor

Table of Contents

Development of a High Energy Amplifier for an Airborne Coherent Wind Turbulence Lidar Sensor, Phase I

Completed Technology Project (2013 - 2013)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
SibellOptics	Lead Organization	Industry	Lafayette, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138088)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

SibellOptics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

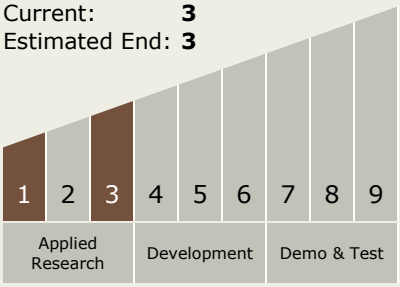
Carlos Torrez

Principal Investigator:

Steven R Vetorino

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Development of a High Energy Amplifier for an Airborne Coherent Wind Turbulence Lidar Sensor, Phase I

Completed Technology Project (2013 - 2013)

Images

Project Image
Development of a High Energy Amplifier for an Airborne Coherent Wind Turbulence Lidar Sensor *(https://techport.nasa.gov/image/136860)*

Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System